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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XLIX
No. 1267

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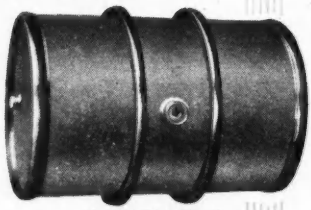

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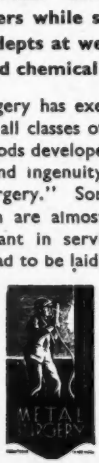

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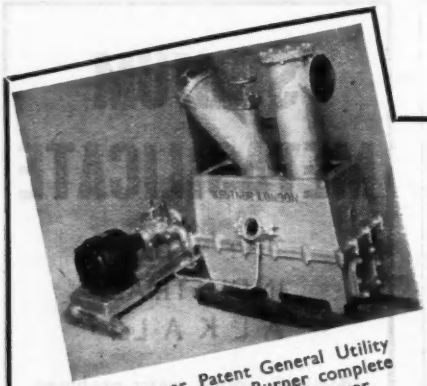

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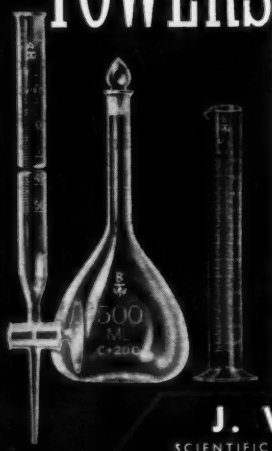

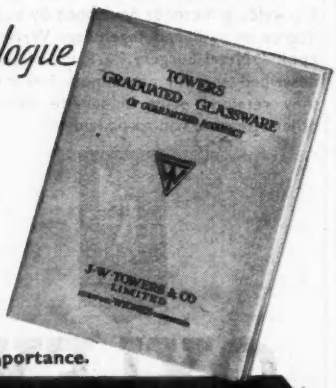

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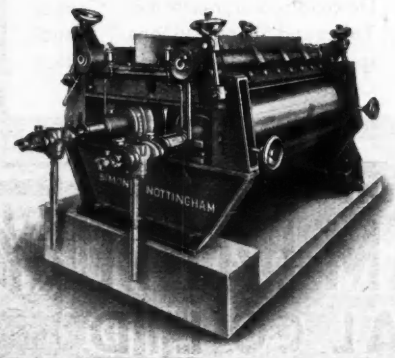

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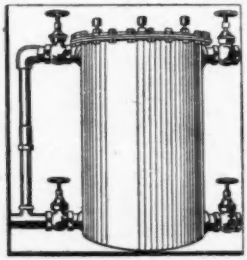

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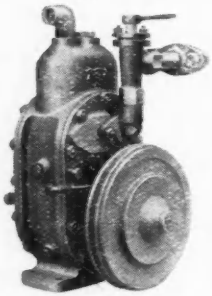

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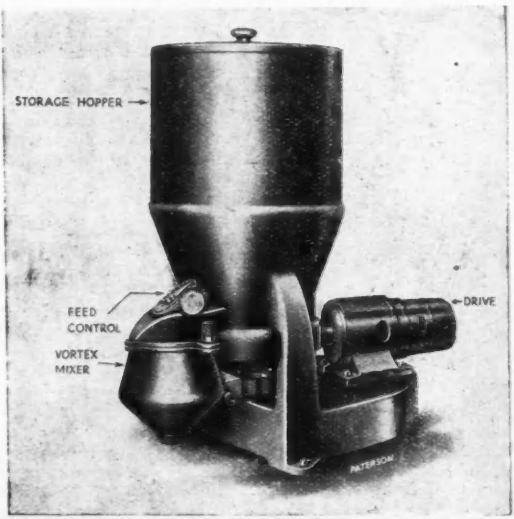

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Raw Materials

A CORRESPONDENT in the daily Press has lately propounded a conundrum that must have perplexed quite a number of people, especially those concerned with the problem in industry. One of the clauses of the Atlantic Charter deals with the problem of raw materials and states what to the man-in-the-street would at first sight appear to be the wise principle of equal access to raw materials for all nations who desire them. It was a cry of the Axis nations that they had no raw materials and that they were denied access to them. That cry was, of course, purely propaganda, and to some extent it was based on the desire that they themselves should possess the raw materials of warfare and should be able in war to deny them to others. Nevertheless, the outcry seems to have had enough substance to cause the writers of the Atlantic Charter to devote particular attention to the problem as one step to be taken to avoid the seeds of future wars. Whatever the reason, the clause poses the right of access of all States on equal terms to the raw materials of the world. But in what manner, it is asked, is it proposed that this principle should be worked out in practice?

Most of the developed States of the world possess important raw materials within their own territories. Take the case, for instance, of Britain's most important raw material, coal. Are all the other States of the world to have the right to have access on equal terms, in any circumstances, to British coal? What kind of arrangements will be necessary to work that out in practice? Or gold in South Africa; or oil in the United States; or the valuable timber areas of Northern Russia; or the nitrates of Chile; or the nickel deposits in Canada; or the chrome of Turkey and the wool of Australia—to cite just a few examples. Is it expected that each of these States will abrogate its sovereign right to deal as it thinks fit with the whole question of raw materials within its own borders? And, if not, what exactly has this particular clause of the Atlantic Charter in view?

This provision appears to cut across the rights of ownership as we now know them. It would not be anticipated, we imagine, that the customers of a colliery company should have equal rights of access to go down the pit and mine their own coal as and when they required it. They would, however, have equal rights to purchase the coal at the

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price which the colliery company finds necessary to charge for it and in the open market. We can imagine, therefore, that the framers of this paragraph of the Atlantic Charter meant no more than just this. All nations and individuals would have the power to purchase whatever raw materials they required on equal terms in the open market. This, however, is no different from what already obtained before the war. All nations were able to purchase petroleum, for example, and any individual in any nation was equally well able to purchase petroleum in as large a quantity as he required and could pay for. The same seems to have been true of practically every raw material. If, for economic or other reasons, a country does not desire to dispose of its raw materials is it to be compelled to do so? Is Great Britain, for example, to be compelled to sell her coal, salt, iron ore, china clay, and so forth, in as great a quantity as any other nation wishes to buy? The answer is, of course, that so far as the coal industry is concerned the pre-war desire was to supply as much coal as could possibly be mined and the coalowners were distraught by the lack of desire on the part of the rest of the world to buy British coal, whereby their export trade fell to very small dimensions. We are now beginning to recognise that coal is a very important asset of this country and to question whether it should be sold to the foreigner in view of the likelihood that many of the best British seams may be worked out within a generation. Are we then to be compelled to sell our coal and to dissipate our assets? We have chosen coal as an example, but the same applies to every other raw material throughout the world and in every country. We can appreciate that the framers of the Atlantic Charter may have meant no more than that no nation should have a "corner" in essential raw materials; but evidently this provision requires a great deal of thought.

A distinction must be drawn between raw materials which can be grown if care is taken to cultivate the crops, and which are to this extent inexhaustible, and minerals which, when once they are taken from the earth, are lost for ever to the vendor. It is very unlikely that raw materials that could be grown, such as vegetable and animal products, will ever require regulation in the sense suggested by the Atlantic Charter. The countries that produce these materials are perfectly ready to sell them, and modern science is making it possible for most of them to be conveyed throughout the length and breadth of the world without deterioration. What is required here is to stimulate consumption, not to insist on equal rights of access.

Minerals, however, are quite different. There is no possibility of replacement and they can be obtained only where nature happens to have placed them. Certain peoples occupying certain lands have these raw materials in or under their country. Nature has given them that privilege and it is one of their assets which they are bound to use to the best advantage for their own development. Because nature has given us coal, which is our only natural raw material of real consequence, there is no reason why we should be compelled to distribute it lavishly all over the world if by so doing we can clearly foresee the approaching exhaustion of our economically accessible coal deposits and our own subsequent disappearance as one of the major industrial nations of the world. Exactly similar considerations must apply to every nation. The matter is complicated also by the importance of certain minerals as war materials.

Dr. C. K. Leith, in his monograph "World Minerals and World Peace" has said: "Each mineral presents a separate, intricate problem with physical, commercial, and political aspects." And those who have considered this problem will agree that the minerals will impose a very severe test for the framers of the plan in free access. So severe is this test that Mr. J. Allan Howell, President of the Institution of Mining and Metallurgy, has voiced the opinion that "it begins to look possible that business will be in full swing before so much as a plan is completed." During the war we have found it possible to replace many "essential" raw materials by substitutes. If nations make use of the resources of science in this direction it would seem possible that science will solve the problem in her own peculiar way by proving, in regard to raw materials as in regard to men and women, that no one is indispensable.

NOTES AND COMMENTS

Higher Technical Education

ALTHOUGH satisfying no one, the Government White Paper on educational reconstruction can at least claim the virtue of having called wide attention to the subject of technical training. Not only have Sir Harold Hartley and Sir Ernest Simon emphasised the importance of the matter and stigmatised our niggardliness of outlay—as compared with that of some other nations—on what is obviously a dividend-paying proposition; but also the authorities in the technical colleges themselves are beginning to plead for a more constructive treatment of their institutions. In a recent letter to *The Times,* Mr. H. Richardson, of Bradford Technical College, directs the attention of the Board of Education to the advantages of *higher* technological training on the lines followed in the United States and certain European countries. Such institutions as the "Boston Tech." have made an outstanding contribution to pure and applied research, and there is no real reason why we should not follow suit. We certainly shall *not* be able to do so, however, if no more than an additional £100,000 is to be spent on the reform of technical education, as Mr. R. A. Butler appears to advocate. Mr. Butler is still to be heard, up and down the country, speaking of the glories of educational reform; if we are to listen to him without our tongues in our cheeks, he will have to tell a more convincing story. Let him only start talking of the *possibility* of developing our larger technical colleges into technological institutes of the first rank, and we shall begin to give our full attention to his lucubrations.

Cleansing European Industry

THE occupation of Italy by the United Nations will be useful in more than one respect. From the industrial point of view it will be specially interesting, as Italy is the first of the Nazified countries in Europe to be freed. One of the first non-military problems to be solved there will be the rehabilitation of the local industry; and some useful lessons for after the war may well be derived therefrom. There can be no doubt that a considerable infiltration of German financial interests into Italy's industries has occurred, though perhaps less overtly than in the *officially* occupied countries. What has happened in those unlucky lands, the articles on Austria and Czechoslovakia, which have appeared recently in our pages, demonstrate clearly enough. Throughout European industries, one of the principal post-war problems will be their de-Germanisation. The big German financial and industrial concerns have wormed their tentacles into every corner of Europe, and these tentacles must be ruthlessly severed. One of the principal dangers lies in the participation of "neutral" interests in the industry of the occupied countries, as only too often the so-called neutral may be merely a nominee of a German concern. As has been pointed out in the *Financial News,* the Cohen Committee is exploring the possibility of making it compulsory for nominee shareholders to disclose beneficial ownership. If this measure comes to pass, it will be a great step towards safeguarding industry against German infiltration. The Germans will do everything they can to keep their stranglehold on European commerce; let us at least do what we can to offer the least possible inducement to would-be accomplices in the dirty work.

Central Europe's Future

A HOPEFUL augury for the future of Central Europe after the war may be derived from the recently published address delivered by Mr. Frantisek Nemec, Minister in the Czechoslovak Government in London, at a meeting of the Association of Austrian Engineers, which is affiliated to the Free Austrian Movement in Great Britain. Mr. Nemec made it quite clear that the idea of a free, independent, and prosperous Austria was fully realised to be in the national interest of Czechosolovakia. The idea had been sedulously circulated by Germany that an economically prosperous Austria was impossible, but this the speaker categorically refuted as nonsense. Citizens of the Central European States, who were now in Britain, regarded it as their prime responsibility to help in the preparation of first-aid measures for the occupied countries after the war, and nine allied Governments of occupied countries now had accredited

representatives on the Inter-Allied Committee of Post-War Requirements, known, from its director, as the Leith Ross Committee. Mr. Nemec expressed his confidence that Austria would receive the same help as the United Nations, and Czechoslovakia would not forget that Austria had been one of her best customers. Any post-war planning of economic organisation should take into account the economy of normal times.

The Need for Chemicals

COMPLETE plans are already in existence covering the requirements of the occupied countries for the first six months after the liberation of Europe, and one of the basic points of view of the members of the Leith Ross Committee is that their aim must be the full employment at home of the people of occupied Europe. One of the main tasks, in which Czechoslovakia and Austria, as the nearest neighbours, may lend a helping hand, will be the industrialisation of S.E. Europe, which so far from merely creating new sources of competition, would in fact provide a new group of customers for the Central European States. The commodities that will be most urgently required by the occupied countries include vegetable and animal oils and fats—in which they were not self-sufficient even in peace time—and chemicals, both raw materials and finished products. The demand for these last is due to the fact that many Central European chemical works are now turning out munitions of war, while others have been (and doubtless more will be) destroyed by hostile action due to the war. Extraordinary importance attaches to the import of fertilisers also, as their quick supply is an essential condition to the recovery of agriculture.

A Timely Warning

CERTAIN Ministers have been long suspected of a love of war-time controls for their own sake, but that affection has never been so clearly exposed as by Mr. Herbert Morrison in his Dundee speech last Sunday. He made it perfectly plain that if he were to have the final word in home policy after the war, British industry and commerce would be under State control for an indefinite period. He advocated the adoption of "a programme of full prosperity under the necessary measure of public guidance and control"—a phrase which has a totalitarian and almost a Japanese ring. One of his arguments was that before the war many of our great industries fell far short of the efficiency of their opposite numbers in America, and that the lost ground could only be made up under public control. He completely overlooked the fact that American industry has leapt ahead since the beginning of the century for the very reason that it was subject to infinitely less Government interference than any of its competitors. Mr. Morrison can be thanked for one thing, that he has given the British business man and worker a timely warning of what is brewing in certain political circles. That such pretensions as his will be fought to the last ditch was demonstrated by Sir Ernest Benn in his Presidential address to the Society of Individualists later in the week.

Equality in Poverty

DENOUNCING the threatened continuance of State control after the war, Sir Ernest Benn drew attention to the disappearance of the words "freedom" and "liberty" from the Government advertising hoardings. "Instead of the inspiration of Freedom," he said, "large sums are now disbursed to enjoin us to save tyres, of which we have none; to become squirrels and hoard coal; to change our overalls for uniform, an interesting illustration of the peripatetic nature of planning. When we have recovered the ability to think as free men, we shall recognise that control at its best is an expensive expedient giving equality in poverty and can never do more than that. It is death to markets—and prosperity and plenty are unthinkable without the market. Much of this talk of control overlooks the proven fact that the State is, and always must be, the most cumbersome, expensive and dilatory agent to employ in any form of practical and constructive work. We all agree that in spite of these handicaps the State must be so employed when war's afoot, but that control should be contemplated for a moment longer than is absolutely necessary is to surrender all hope of well-being and to abandon all thought of progress."

Physics in Chemical Industry*

Important Applications in Analysis and Testing

THE most outstanding applications of physics to chemical industry lie in methods of analysing and testing products. Advance in the last ten years has been mainly in the simplification of instruments, so that they can be used by unskilled or semi-skilled operators. There have also been new applications, such as that of X-ray diffraction, which, however, have not yet been sufficiently simplified to be in general use as routine methods. They are, however, of great value in industrial research laboratories.

The determination of viscosity often provides much information concerning the nature and purity of a product, and provides an outstanding example of the aid the physicist can offer to the industrial chemist. Viscosity determinations have formed part of the routine work in many chemical industrial laboratories for many years, though the viscometer has found new uses within recent times. With a simple viscometer of the MacMichael type, based on the torsion principle, the instrument can be calibrated with liquids of known coefficient of viscosity, so that all that is necessary is to read off the viscosity of the sample on a dial. The viscometer is now used in the paint and varnish industry, and in the manufacture of such diverse products as asphalt, chocolate, grease, ice-cream, and glue.

Refractive-Index Determination

The refractive index is another important physical property of a substance by which it can be identified, and its degree of purity ascertained. A projection refractometer has been put on the market by Bellingham and Stanley, Ltd.,[1] for the determination of the sugar contents of jam and other sugar-containing liquids. It is a massive instrument, well suited to the demands of industry for a sturdy piece of apparatus. It has a scale already calibrated in sugar content, and in addition a refractive index scale reading from 1.3820 to 1.5165. The Fisher Scientific Company, of Pittsburgh, have also developed an exceedingly simple refractometer in which the image produced by light refracted by a drop of liquid in a small prism is seen on a scale calibrated directly in refractive index. The refractive index can be determined to 0.002, and a sample of 0.001 ml. is sufficient for the determination. The instrument is widely used in the sugar industry, and in the manufacture of organic compounds.

The measurement of *p*H is of very frequent application in chemical industry; it is impossible to do more than mention a few of the processes in which this method of control is used. Modern apparatus is very simple to use, and is usually self-contained. Essentially, of course, the apparatus consists of two electrodes and a potentiometer with its necessary adjuncts. The potentiometer is usually directly calibrated in *p*H units.

Apparatus for *p*H Control

Of such importance is *p*H determination in chemical industry that apparatus has been devised for remote indicating and continuous recording of *p*H values. Readings can be taken by unskilled workmen. Automatic recorders are also available, as are alarms which ring when the *p*H varies from a predetermined value. Special electrodes have been devised for continuous industrial use. For example, it may be necessary to determine the *p*H of a flowing liquid. In this case, a specially robust unit is fitted directly into the pipe-line, and it is connected to a potentiometer at a distance.

Control of *p*H enters into almost every operation of industrial chemistry, and the chemist owes much to the physicist for the development of the necessary instruments. In the manufacture of jams and jellies, the gelling is affected by the *p*H of the medium; the optimum *p*H for the gelation of pectin, for example, is 8.0, and for that of pectase, 4.8. In the refining of sugar, much waste can be avoided by correct *p*H control. In the textile and dyeing industries, *p*H determination is invaluable for controlling processing to avoid damage to fibres. The *p*H of dye baths is important in obtaining best results. In the preparation of photographic emulsions, the size of the silver halide particles is considerably affected by the *p*H of the emulsifying medium. In the manufacture of pigments, *p*H determines the covering power, the colour brilliance, and the reproducibility of shade.

Electrometric Analysis

Analysis by electrometric methods is now frequently used instead of ordinary volumetric analysis, the process simply making use of the sudden change in conductivity of a solution, or of the e.m.f. between two electrodes, at the "end-point" of a reaction. The advantage lies in the fact that this method does away with the need for a visual indicator, which sometimes does not give sharp colour changes, and which, in any case, must make the process subject to the personal error of different observers. By means of electrometric titration it is also possible to titrate the turbid and coloured liquids, often met with in chemical

* Abridged from an article by A. J. Mee, M.A., B.Sc., of Glasgow Academy, in the *Journal of Scientific Instruments*, September, 1943.

industry, and difficult to estimate by the usual methods. The trend in recent years has again been towards simplification of the apparatus so that operators with little experience can master the process quickly. The most modern form of the apparatus illustrates this point. The Fisher Titrimeter consists essentially of two burettes, and a combined rotating electrode and stirrer. An amplifier is used to step up the p.d. of the electrodes, and pass it on to a " magic eye," which is mounted on the burette stand. This application of the cathode-ray tube is similar to that employed in radio sets to indicate perfect tuning. The end-point of the titration is unmistakable because at this point the " magic eye " blinks, and then, as the end-point is passed, the aperture converges or diverges. The change is immediate, and is perfectly definite, and personal errors are almost eliminated.

The Polarograph

The polarograph is another application of electrochemistry to chemical analysis which is now becoming widely used in the chemical industry. The polarograph involves the variation of current flowing through a solution as the potential applied to a dropping mercury electrode is altered. The curve drawn between electrode potential and current shows a number of inflexions, each of which indicates the presence of some particular ion in the solution. The apparatus has been made automatic by Heyrovsky and Shikita. The potential of the electrode is varied by putting into the circuit a gradually increasing length of wire which is unwound from a drum worked by a clock. On the same axle is geared a roll of photographic film, and the movement of a beam of light reflected from the mirror of the galvanometer used to measure the current flowing is registered on it. In this way a polarogram is obtained which indicates the presence of certain ions. The method is of particular value in the detection and approximate estimation of traces of impurities, and it is being increasingly used in the chemical industry, particularly in the ceramic, sugar, and fermentation industries. It is also of value in water testing. Only small quantities of substances are required for analysis, and for sensitivity the process approaches the spectrographic method of analysis.[2]

Spectrographic Analysis

One of the earliest applications of physical instruments to chemical industry was the use of the spectrograph for the identification of substances. Recent developments[3] have been aimed at making the process more simple to carry out, and at the use of the method for quantitative analysis. There are various methods of exciting the spectrum. The electrodes commonly used are of carbon, aluminium, copper, or silver. These elements give rise to few lines of their own, and they can be readily obtained pure. Sometimes the sample itself is used for the electrode material, between which an arc or, sometimes, a spark is passed. Sometimes material is sprayed into an air acetylene flame.

The spectrogram is photographed on a plate, and has then to be examined. Visual inspection will often suffice to fix the presence or absence of any particular element, but the process can be simplified by taking comparison spectra with electrodes or substances containing known elements.

Simplified Apparatus

An excellent example of simplification of apparatus and technique in this field is provided by the Spekker Steeloscope,[4] an instrument used for the rapid detection and estimation of nickel, chromium, molybdenum, manganese, titanium, tungsten, cobalt, copper, tin, cadmium, and vanadium in steels. Specimens of the steel are used as the poles of an arc and the spectrum is obtained in the usual way, but there is a movable eyepiece. This can be moved to definite positions indicated by chemical symbols engraved on it. When the eyepiece is moved into one of the positions, the line of that metal will appear in the centre of the field of view if the metal is present. In this way the instrument has been so simplified that it can be used by an unskilled worker. It is also possible to use the instrument for the quantitative determination of any of the above metals in steel by comparing the intensity of the line of the metal with the neighbouring iron lines. It is also possible to compare the intensities of the lines with those of metals in standard samples containing definite percentages of the metals.

Photocells

For accurate quantitative analysis it is necessary to use a microphotometer. A typical instrument is the Hilger non-recording photo-electric microphotometer. Light is passed through the spectrum line on to a " sperrschicht " photocell. The deflection of a galvanometer connected with the cell is proportional to the density of the line. For small concentrations, the latter is proportional to the atomic concentration of the element present. All elements, except non-metals, can be estimated by this method. The least amount of metal detectable is 10^{-6} to 10^{-9} gm.; for the more difficult elements, such as phosphorus and arsenic, the lower limit is 10^{-5} gm.

The photocell has found many applications in physical apparatus used in chemical industry and has been employed notably in colorimetric analysis. In the older visual method, there was always the possibility of

personal error in matching colours, even with the best apparatus. This source of error has been completely eliminated in the photo-electric colorimeter, the accuracy of which far exceeds that of any visual colorimeter, and the results are reproducible to one-half per cent. The instrument can be used by inexperienced workers after little practice, and finds application in routine chemical analysis, such as the estimation of tungsten, titanium, chromium, aluminium, etc., the testing of products such as inks, dyes, gelatins, solvents, petroleum products, etc., and in biological work.

The photocell has also been largely used as an adjunct to a number of other instruments. For example, there is a photo-electric saccharimeter[5] for the analysis of sugar solutions. It has also been suggested for the measurement of the temperatures of flames and hot gases.[6] Photo-electric apparatus has been devised for the detection of various gases, such as methane[7] and hydrogen sulphide.[8] It has also been applied to the spectrophotometer for the determination of spectral densities.[9] The photoelectric grading of sands, clays, and dusts—a problem concerning the agriculturist, the ceramic industry, and the production of such widely different substances as pottery, paper, and face powder—has been described by Professor E. G. Richardson.[10] Recently, a photo-electric method of investigating the colours of oils has been described.[11]

X-Rays

The use of X-rays in chemical industry[12] can only be described as enormous. To mention but a few applications, in metallurgy X-rays are used to detect flaws, such as slag inclusions in castings, gas blowholes, and shrinkage cavities. In the manufacture of plastics they can be used to discover whether the material is homogeneous. They are also employed in the detection of foreign bodies in such products as food and tobacco. But quite apart from such radiographic applications as the above, the phenomenon of X-ray diffraction provides application of X-rays to chemical industry, particularly in the research that must be carried out to discover the most effective method of control for a process, or the best way to obtain a desired product. This method of X-ray analysis is not generally available for routine work by unskilled operators, metallurgical, or allied, although some believe that it will be in due time. Its place now is in the research laboratory of a large chemical industrial concern.

The method usually employed is the powder technique. The powdered substance to be examined is packed into a glass capillary tube, and is then irradiated with X-rays limited by slits to a width of about 0.5 mm. The diffraction pattern is photographed on strips of film. To use the process for identification it is necessary to have available a large collection of patterns produced by known substances. Such a collection of 1000 patterns has been published by Hanawalt, Rinn, and Frivel,[13] and an extended index is being produced as a co-operative effort of the Institute of Physics with the American Society for Testing Materials and the American Society for X-ray and Electron Diffraction. The method can be used for the quantitative analysis of substances by estimating the relative intensities of the diffraction patterns of the substance and a series of known standards. An accuracy of 1 per cent. can be achieved using a photo-electric photometer, and about 5 per cent. by visual comparison. As an example, it may suffice to quote the results of an analysis of an alloy of silver and gold obtained from sea water. The specimen weighed only 0.0001 gm. but was found to contain 32 per cent. of gold and 68 per cent. of silver, with a possible error of 3 per cent.

X-ray analysis provides one of the best methods of investigating alloys. Its scope was fully discussed at a recent meeting in London.[14] It probably will not entirely replace other methods, and it is usually advisable to employ the microscope as well as X-ray analysis to identify phases and their transformations. For rough accuracy, such as is usually required in industry, it is best to use X-rays in conjunction with the older methods. X-rays are more effective in the study of phase transformations occurring at low temperatures, while the older methods, such as the microscopic method, and that of thermal analysis, are better for higher temperatures. It has been pointed out that the powder technique does not always give the sort of result that is of value to industry, as it deals with an alloy in the powdered form. In industry it is often the gas content of an alloy that is of importance.

Chemical Uses of Diffraction

More specific uses of X-ray diffraction in chemical industry have been detailed by C. W. Bunn.[15] The constitution of bleaching powder has been examined by this method by Bunn, Clark and Clifford,[16] who reach the conclusion that commercial bleaching powder is a mixture of a compound of the formula $CaCl_2.Ca(OH)_2.H_2O$, with a phase containing 80-90 per cent. of calcium hypochlorite. The X-ray method gave results in this instance where all other methods failed. The structures of the various coloured oxides of iron have been determined by X-ray analysis where the microscopic method failed because the crystals were too small; the yellow oxide pigments were found to differ from the brown ones in the dimensions of the unit cells and in the arrangement of atoms in the cells. The constituents of boiler-scale have been identified by X-ray diffraction. To discover the solu-

bility relations of these scales, "artificial" scales were prepared in the laboratory,[17] the preparation being controlled by X-ray methods. The synthesis of a number of calcium silicate minerals was carried out in this way.

X-ray diffraction methods have also been largely used for the examination of glasses and plastics, and to determine the composition of clays. The setting of plaster of Paris and of cement has also been investigated. The field of the application of X-ray analysis methods to problems of chemical industry is almost unlimited. The somewhat similar technique of electron diffraction can also supply much information to the industrial chemist, particularly on the nature of surfaces.

The development of the electron microscope opens up new fields in investigation and analysis of industrial products, but at present the instrument is scarcely out of the academic research stage. There is little doubt, however, that when simplification can be effected in the construction and use of this instrument it will find considerable application in the chemical industry.

Magnetic Determinations

It was shown by Madame Curie, in 1898, that the magnetic flux through a specimen of hardened steel when placed in a magnetic field varied with the carbon content of the steel. This fact is made use of in a modern instrument for the rapid determination of carbon in steel.[18] In essence, the sample is made the core of a small transformer, and the current induced in the secondary when an alternating current is passed through the primary is determined. This current varies with the carbon content of the steel, and from the deflection of the instrument in the secondary circuit the carbon content can be read off from a calibration table. The great advantage of the method is that an analysis can be carried out in 5 min. from the molten metal to the final report, whereas the chemical determination of carbon could not be done in less than 15 minutes. This is important in the Siemens-Martin open hearth process.

Detection of Flaws in Steel

A method of detecting faults in iron rails at high speeds has been described,[19] which is an interesting application of physical principles. The iron rail is magnetised by a suitable magnetising current, and variations in the magnetic field are detected by means of a thermionic valve. The top of the glass bulb of the valve is flattened, and the anode is semi-cylindrical with its open side towards the top of the valve. The cathode is on the axis of the anode, and as near as possible to the glass. The valve is used with its flattened top as near as possible to the rail, and can be moved along at the rate of 6-15 m.p.h. The effect of the magnetic field is constant until a defect in the rail causes discontinuity. The current in the valve is amplified and its variation observed by means of a milliammeter or an oscillograph.

Crack Detection

An interesting application of ultrasonics to crack detection has been made. The method was first suggested by Sokolov, in 1929, but has now been extended by Behr[20] and Shrayber.[21] Ultrasonic waves travel in well-defined beams in homogeneous substances, but if there is any inhomogeneity, such as a slag inclusion, or a blowhole or crack, the waves are reflected or dispersed. The distribution of the transmitted beam may be investigated by the usual methods, such as the use of a piezo-electric detector, or the examination of the ripples formed on the surface of an oil bath in which the specimen is immersed.

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An electronic method of dehydration, depending on the dielectric-loss effect described in THE CHEMICAL AGE of August 28 (p. 210), has been worked out by the Federal Telephone and Radio Corporation, in conjunction with the Quartermaster-General's department of the U.S. Army. It is claimed that 99 per cent. of the moisture can be removed from a block of vegetable material by this method.

Chemical Treatment of Timber

The Application of Pressure Processes

A FEW weeks ago we published an article on the use of urea in the seasoning of timber (THE CHEMICAL AGE, *49*, 1259, p. 153) derived from a pamphlet issued by the Timber Development Association and including some interesting facts concerning American practice. Further details of the methods utilised for the chemical treatment of wood in the United States have been described by W. P. Arnold, of the Technical Department of the Koppers Company (*Chem. and Eng. News*, *21*, 14, p. 1168).

The timber, or lumber, industry is the second largest in the U.S.A., says Mr. Arnold, and the necessities of war have demonstrated the tremendous possibilities of wood while at the same time calling attention to its weaknesses. Timber possesses the objectionable property of lacking resistance to decay, to insect attack, to marine borer attack, and to fire, and various types of preservatives have been employed to counter these defects.

Improved Penetration

For wood preservatives to be effective, they must penetrate into the wood. Surface applications by brush or spray are not effective because the penetration obtained is slight and the penetrated shell is soon broken through by subsequent abrasions. The untreated wood beneath the surface is then exposed to decay or insect attack and the purpose of the treatment is defeated since the wood will be destroyed in spite of the treated surface. Preservative treatment of timber by dipping or soaking in open tanks results in somewhat deeper penetrations than brush or spray applications. The so-called hot and cold process is the more effective of the open-tank treatments. In this method the timber is heated in the preservative in an open tank for several hours, then submerged several hours in the cold preservative. As the timber cools in the cold bath, contraction of the air within the wood brings about somewhat better penetration than mere prolongation of soaking in the hot preservative. Since some types of wood are highly resistant to penetration, the results obtained by the open-tank methods are not dependable and cannot be controlled as desired.

Treatment by a pressure process is required to secure the penetration necessary for effective protection. Three different pressure processes are recognised. They are all the same in principle but differ in detail. The timber to be treated is placed on small steel trams which are then run into steel cylinders. These cylinders may vary from 30 to 150 feet in length and from 5 to 9 feet in diameter. After the wood is in place, the door of the cylinder is closed and the cylinder is filled with preservative. The pressure of the preservative is then raised to and maintained at 100 to 200 lb., according to the kind of timber treated, until the wood has absorbed the desired amount of preservative. With creosote treatment the minimum amount of preservative retained by the wood is generally held at about 5 lb. per cubic foot of wood.

Three Techniques

There are three pressure processes in general use: (1) the Bethell or Full-Cell process; (2) the Rueping process; and (3) the Lowry process. The last two are so-called empty-cell processes. Under all three methods the wood must first be conditioned for treatment by natural air seasoning or by artificial methods. The conditions of treatment, absorption, and penetration of preservatives are carefully controlled by means of suitable devices for the measurement of pressure, temperature, and volume or weight of preservative. The process employed depends on the intended use of the treated wood. In addition to proper penetration of wood, it is necessary that the preservative used remain in wood for long periods of time—*i.e.*, its loss from the wood by leaching or evaporation and its resistance to adverse chemical action must be slow.

Two preservatives of many tried—creosote and zinc chloride—have stood the test of time, having been in use for over 100 years. Until recently they accounted for over 98 per cent. of all wood treated and still account for 95 per cent.

A wood preservative should protect timber for from 20 to 50 years, which renders it difficult to assess the value of new preservatives. However, some of the qualities necessary for a wood preservative can be evaluated in a relatively short time. A good wood preservative should be toxic to wood-destroying fungi. It must possess chemical and physical qualities which give it satisfactory permanence under the conditions recommended for its use. It must be relatively free from objectionable qualities, such as corrosiveness to plant or metal attached to the treated wood, and from detrimental effect on the strength of wood. It must be subject to satisfactory plant and laboratory control. It must prove to be a preservative by experimental and service data. It must not endanger health or increase the fire hazard.

Among the materials employed for impregnation of wood to protect it against decay, insects, and marine borers, coal-tar

creosote is the most widely used. In 1942 over 300,000,000 gallons of creosote were used for wood preservation of more than 4,000,000,000 linear feet of timber. Besides providing protection against decay and insects, creosote imparts many desirable properties to wood. It is the only material which is trustworthy for protection against marine borers. Proper processing produces surfaces which are not oily, so that the wood may be used in general construction where odour and colour are not objectionable. It is suitable for all parts of buildings except heated interiors. Where its natural colour is suitable, need for painting is eliminated, although to a limited extent it may be painted if desired. Certain types of aluminium paint are most satisfactory, but good progress is being made with white and coloured paints. Creosote also appreciably increases the resistance of wood to abrasion, checking and distortion. Its lubricating effect reduces the tendency of fibre-tearing or slivering. Its water-resistance reduces the rate of absorption and evaporation of water, thus preventing rapid changes in moisture content, which induce checking and distortion of wood.

Salt Treatment

When the odour or the limitation on painting is objectionable, the so-called salt preservatives are used. These do not change the odour of wood and allow of painting as readily as does untreated wood. Salt treatments do not change the natural characteristics of wood. The quality and use of salt preservatives are covered by official specifications. Generally, wood treated with these materials is confined to the above-ground portions of structures, because of their lower resistance to deterioration by ground-water action, leaching in particular.

The following salt preservatives are most widely employed, listed in order of quantities used in 1941 as reported by the U.S. Department of Agriculture:

1. *Chromated Zinc Chloride*, essentially a mixture of 5 parts of zinc chloride and 1 part sodium dichromate. Approximately 4,383,000 lb. were used in 1941.

2. *Wolman Salts*, essentially a mixture of 3 parts sodium chromate, 2 parts sodium fluoride, 2 parts sodium arsenate, and 1 part dinitrophenol, or equivalents. In 1941 about 1,660,000 lb. were reported used.

3. *Zinc Meta-Arsenate*. This material is used as such in an acetic acid solution. In 1941 about 270,000 lb. were reported used.

4. *Copper Sulphate-Sodium Bichromate* mixtures to the extent of approximately 310,000 lb. were used in 1941.

Large quantities of pentachlorophenol were also used. Unlike the so-called salt preservatives, pentachlorophenol is used not in aqueous solution but in petroleum solvents. By using a highly volatile solvent, this preservative may be injected into wood without causing it to swell and without need for subsequent kiln-drying or delay in air-drying.

Fireproofing of Wood

Early methods for fireproofing wood involved the application of various chemicals to the wood surface by brushing or dipping. These methods, while still sometimes employed, are at best temporary and unreliable. The thin shell of fire-resistant coating usually will be damaged and rendered ineffective by cracking, abrasion, or moisture so that a fire will penetrate quickly to the untreated wood underneath. Covering wood surfaces with non-combustible material is uneconomical and less effective than fireproofing the wood itself through chemicals deeply injected by pressure treatment.

Investigations on a large scale by fire-testing organisations have shown that wood impregnated under pressure with certain chemicals in water solution will reduce its fire hazard in proportion to the concentration of chemicals injected. Combinations of ammonium phosphate, ammonium sulphate, zinc chloride, or chromated zinc chloride, boric acid, and borax are used. The wood preservatives zinc chloride or chromated zinc chloride alone will impart effective fire retardance. When used in concentrations of from two to five times the minimum specified for decay protection, increasingly effective fire resistance is obtained in addition to protection against decay and insects.

Wood is naturally resistant to action by acidic water or vapour, but continued exposure to dilute acids or alkalis causes gradual decomposition. Therefore, wood is sometimes treated to increase its resistance to such action. Surface coatings are commonly used for that purpose, but are not durable nor dependable. Best protection is obtained by loading the wood cells with inert resinous materials, which prevent absorption of the liquid, thus preventing its contact and adverse action on the wood itself. This may be done by impregnation with certain types of resins in oil or water solution, or the resin may be formed within the wood by separate treatment with the reacting components. Since large quantities of these materials are required for effective results, such processes are very expensive. An inexpensive treatment can be obtained by using coal-tar pitch compounds of suitable properties, impregnated into the wood by means of a pressure-treating process developed for the purpose. The relatively low cost of this treatment suggests a diversity of uses as yet unexplored.

One of the undesirable properties of wood where precision dimensions are required is the swelling and shrinkage with change in moisture content caused by exposure to changing humidity or to aqueous liquids.

Again, formation of certain resins within the wood stabilises the wood. The most effective of these swell the wood as does water, but when set up within the wood, they prevent its shrinkage upon subsequent drying. In other words, they give the wood a permanent " swell." As yet these methods are too expensive for application other than for specialities, not for preventing wood doors, windows, or drawers from sticking. Research in this field holds interesting possibilities.

Fireproofed wood will become increasingly important and useful. Acid- and alkali-resistant wood has many potential applications for tanks, platforms, drains, and generally where corrosive materials might come into contact with parts of the structure involved. The value of wood beams and trusses is being demonstrated to-day. Wood beams over 100 feet long are being made up by gluing together thin, short pieces of timber. With increasing scarcity of large timbers, such laminated beams will take an increasingly important part in wood construction. When protected against decay and fire they should prove to be economical competitors to steel and concrete.

The great diversity of existing potential uses for wood, development of possible new uses with new treatments, and the improvement in design and production of prefabricated treated products hold promise of new business for many years to come. Development of suitable designs and production of prefabricated treated farm buildings has already started.

Chemical Firm Fined

Sewage Works Affected by Effluent

NEMLIN CHEMICALS, LTD, Bury, Lancs., were fined £10 at the Bury Police Court last month for an infringemen of the Public Health Act, 1936, by turning into a drain a liquid likely to affect the treatment and disposal of sewage.

Mr. H. T. King, for the company, said the drainage of Trade Premises Act, 1937, applied and the circumstances ought to have been referred to the Ministry of Health, for a public inquiry. The Local Government Act of 1933 stated quite clearly that no officer of a Corporation should commence any proceedings unless a resolution was proved that he was authorised to do so. To this, the Town Clerk replied that any inhabitant could lay information against someone doing harm to the sewage works. The company had no legal right to discharge trade effluent into the sewer. The chairman of the magistrates said the bench was of opinion that Mr. Walter Scott could lay information in his private capacity and there was nothing in the summons to indicate that he had laid the information as a servant of the Corporation, in his capacity of sewage works manager. The bench did not agree that the drainage of Trade Premises Act permitted the release of trade effluent into the sewer.

The prosecution alleged that the trap in the sewer was covered with a deposit of tar. It was stated that on the afternoon of July 31, there was a heavy discharge of tar at the sewage works which caused the plant to be closed down for five hours. Mr. Walter Scott, sewage works manager, said he had conducted experiments which proved the deleterious effects of tar on the process of sewage purification. He would never agree to accept tar and did not know anyone who could treat it at a sewage works.

Mr. King said that the Corporation had for some years struggled to run the tar works, had been unsuccessful and decided to sell it. It was a statutory obligation on a Corporation to provide sewers for businesses in their own area. The Corporation sold the business knowing full well what the effluent would be and knew that they must accept it. Those were the conditions from 1936 until 1942, when the scheme was improved by the installation of tanks. The Corporation then endeavoured to impose conditions, which he advised the company not to accept.

Lever Brothers

Points from the Chairman's Statement

THE annual meeting of Lever Brothers and Unilever, Ltd., was held on Thursday last, and the report for the year, circulated previously by the chairman, Mr. Geoffrey Heyworth, contains some points of interest for the chemical industry. The effect of soap rationing, introduced early in 1942, had been to reduce the consumption of oils and fats used as soap in the home by 18 per cent. for 1942. The effect in 1943 will be slightly greater. Seed-crushing showed a slight increase in 1942, but continued below the pre-war level. Refining and hardening remained above normal. The volume of animal feeding stuffs continued to contract, but there has been some improvement in recent months. The production of margarine in Palestine and soap in Nigeria was substantially expanded during the year.

During the year research work was concentrated on problems connected with the war effort and on investigations undertaken at the request of Government Departments. The board is mindful of the importance of all sections of the business keeping in the forefront of new developments A new central research laboratory was completed and occupied during the year, which provides for the considerable additional staff required to carry out enlarged programmes of research for work on food products that have been lacking hitherto.

The Future for Paint

Chemical Points in Mr. Bennett's Address

IN his chairman's address at the opening meeting of the 1943-44 Session of the London Section of the Oil and Colour Chemists' Association at the Charing Cross Hotel, London, recently, Mr. N. A. Bennett discussed the position the paint industry is likely to have to face in the post-war period and endeavoured to answer some of the queries which were in the minds of those in the industry. He said that the shape of things to come in the paint industry, as indeed in all industry, would be conditioned by three main factors—political, economical and technical.

Speaking of the future, he indicated his belief that the main hope of the paint industry lay in the industrial field by the introduction of types of paint able to aid increase of speed of production and possessing greater and still greater durability. The new idea of regarding the natural oils and to some extent resin, notably shellac, as primary raw materials capable of being converted into highly chemically active compounds suitable for incorporation into synthetic resin during the manufacture of the latter, opened up endless possibilities of obtaining rapid "set" coupled with greater durability.

Varnishing Glass

As paint films of greater toughness and surface hardness were produced, the metal-finishing industries would be able to make greater and greater use of paint. There was an actual example of resins which had been known for a long time coming into prominence and commercial production at the very moment. Glass-covered conductor wire and woven-glass tapes in the electrical industry were superseding wire and tape covered with or made of asbestos. The preference for glass was due to its ability to keep its condition at much higher operating temperatures. This involved the problem of finding an insulating varnish which would not deteriorate at temperatures between 200° and 300°C. The solution to this problem was being found by the utilisation of varnish based on synthetic resin in which carbon was largely replaced by silicon. This particular use of silicon-bearing varnish pointed the way to new uses of suitably modified varnish of similar general structure. Broadly speaking, high temperature had been the Achilles Heel of the paint technologist, but if this traditionally vulnerable spot could be armoured, all manner of dazzling possibilities appeared.

Some held the view that unless the varnish plants associated with paint producers were turned into the requisite type of chemical plant capable of producing the synthetic medium for all the main types of paint which its owners marketed, the paint industry would first become a second-rate industry just pigmenting the finished products of the synthetic medium manufacturer and finally would disappear by the absorption of this part of the paint production process by the medium manufacturer. If the paint manufacturers did convert their varnish plants, the boot might be on the other foot, and synthetic resin manufacture might be absorbed into the paint plants. This scheme of things, however, made inevitable the coalescence of paint production units, arising from purely economic grounds, as the production of synthetic media by at least 60 per cent. of the present members of the industry would be hopelessly uneconomic, since such media would not lend themselves to small scale production.

Others in the industry said that even if the whole of the paint industry bought its medium ready made, the paint industry would still exist as an industry distinct from the medium industry. Its function would be to pigment the media and to determine the best use to which the paints should be put. In this form the paint industry could continue as a more or less small-scale production industry.

This move towards chemically-produced synthetic media was a move towards making paints better for their present uses and the production of new paints having properties which would enable the industry to extend the scope of its activities.

Emulsification Improvement

There was another important development taking place which, while not making paints any better, held the possibility of making good paints more cheaply, *viz.*, the use of argillaceous matter and water. Neither were new ingredients, but improvements in emulsification technique made it appear highly probable that most types of paint could be cheapened by emulsification with water without detriment to their finish or durability. Then the use of fluorescent substances as paint pigments had a much wider field of interest than many imagined. From fluorescent surfaces absolutely glareless lighting could be obtained and, on this account, the use of fluorescent paints on walls and ceilings in all kinds of buildings as a matter of both decoration and illumination held many attractive possibilities.

A.C.S. Meeting at Pittsburgh

New Uses for Lactic Acid

THE American Chemical Society met on September 6-10 in Pittsburgh. One paper, by John W. Robertson, entitled "The Possibilities of Radio-Power for Processing Chemical Materials" dealt with the subject of dielectric heating, about which THE CHEMICAL AGE (August 28, p. 210) published an article recently. Mr. Robertson told how to-day radio engineers in America, in co-operation with chemical engineers, are working hard, trying to use the phenomenon of dielectric loss to heat a load of chemicals more quickly and efficiently and to take advantage of any catalytic affects due to the method. He advised caution on the part of those who propose to enter this field of study as it would be undesirable to give the method a "black eye" by widespread applications which have not been fully worked out by engineers or for which it is not economically suitable.

D. F. Othmer and H. L. Kleinhans, of the Polytechnic Institute of Brooklyn, described how the partial pressure process had been applied to the nitration of toluene for the production of mononitrotoluene in a distillation unit using nitric acid alone. The authors considered some of the advantages, such as higher yields, lower heat costs and possible lower equipment costs of a continuous process without the use of sulphuric acid.

Hydrogenated Tall Oil

The separation of fatty and rosin acids from tall oil was considered in a paper by G. Papps and D. F. Othmer. The two main components of hydrogenated tall oil are stearic and abietic acids, which can be selectively adsorbed by feeding an 8 per cent. solution of the hydrogenated oil in a suitable solvent through a column containing activated carbon. The abietic acid is then washed through the column by fresh solvent, the stearic acid which is more tenaciously adsorbed being removed by the use of additional solvent; 29 solvents were tested, and nitropropane-1 was the most successful, removing 80 per cent. of the abietic acid and 90 per cent. of stearic in one passage through the column.

A process for making aminoguanidine, a dyestuff intermediate, by the electrolytic reduction of nitroguanidine was outlined by R. N. Shreve and R. P. Carter. The nitroguanidine resulted from the dehydration with sulphuric acid of guanidine nitrate, which, in turn, was derived from dicyanamide by heating with ammonium nitrate. According to a further paper by these two chemists, presented in conjunction with J. M. Willis, of du Pont de Nemours & Co., aminoguanidine has been diazotised and coupled with various intermediates, to furnish azo dyes of good dyeing properties on animal fibres such as silk and wool. Such dyes are of various shades, browns and oranges predominating. The diazotisation of the aminoguanidine was carried out in a neutral aqueous solution, forming the very slightly soluble diazonium hydroxide derivative, which was then coupled with the dye intermediates in hot aqueous solution, under controlled conditions of *p*H, to give the various dyes. These are soluble in alkaline solution, but are precipitated by acids.

Commercial Lactic Acid

Corrosion was described as the greatest problem of lactic acid production in a paper by G. T. Peckham, of the Clinton Co., Iowa, on commercial lactic acid preparation. He said that no wholly satisfactory plant material had yet been found for the purpose; metals, ceramics, resins and rubbers all had limitations, the metals being corroded and the other materials being low in heat-transfer capacity. U.S. production was now probably twice the pre-war figure, being made by the fermentation of (1) starch hydrolysates of varying degrees of purity, (2) molasses, or (3) whey. Edible and higher purity acids could be made from any of these substrates, as well as crude acids. In some cases the substrate was refined; in others, calcium lactate was crystallised out as the primary refining step, while in still others, solvent extraction was employed. Crude acids were largely characterised by the starting substrates and methods of processing, but these factors had little if any effect on the better grades.

An account of the uses of lactic acid and its derivatives in the pharmaceutical industry was presented by W. R. Jackson, of Merck & Co. Because of its low toxicity, its miscibilty in water, alcohol, glycerol and ether, its syrupy consistency and convenient *p*H, lactic acid lends itself to a multitude of pharmaceutical purposes. As an acidulant and preservative it is found in various preparations to be taken internally. Milk with lactic acid is well tolerated by infants and is used extensively in feeding formulæ. Lactic acid-calcium lactate paste may be used by confectioners, as sugar solutions can be jellied by the addition of calcium lactate. Lactic acid is used in preparing vaccines and in the lyophilising of blood plasma. It has proved its value in dentistry as a remover of tartar. It is incorporated in the majority of vaginal jellies. Since lactic acid is a good dispersing agent it can be used in making emulsi-

fied ointments and liquids. Silver lactate is an antiseptic used in dentistry. Ethyl lactate is used as a lubricant in the manufacture of tablets. Sodium lactate is extremely hygroscopic and makes a good humectant in pharmaceutical preparations. It is a good buffer. Its solutions are stable and can be sterilised by boiling; they are preferred to sodium bicarbonate solutions for intravenous injection in cases where the buffer balance of the body must be restored quickly. Lactate-Ringer's solution has recently been accepted as a new and unofficial remedy. Calcium lactate is used widely in calcium therapy, for which it is available in tablet form for oral use and as a 5 per cent. solution for injections. Aluminium lactate is used as an anti-perspirant. Aqueous solutions of potassium and sodium lactate are used as glycerol substitutes, being colourless, viscous liquids, with a pleasant taste and similar physical properties to glycerine.

Lactic Acid in Tanning

The entry of lactic acid into various other industries was described by a number of speakers. E. T. Margolis said that the degree to which it would be substituted for citric and phosphoric acids in mineral-water manufacture would depend on the ability of the acid producers to meet price competition and to overcome the prejudice against its extraneous flavour and odour. In the leather industry, said R. M. Lollar, of Department of Tanning Research, the Foundation Tanners' Council of America, lactic acid and lactates had three major uses. They were used to de-lime the limed skins, to control acidity during vegetable tanning, and to neutralise and stabilise certain mineral tannages. Originally, most lactic acid used in tanneries was produced by fermentation in the tannery. Research had shown that tannin inhibited the production of lactic acid, for which the optimum temperature was between 25° and 30°C. The development of acidities producing *p*H levels below 4 prohibits further production. For various reasons many tanners now prefer to add commercial lactic acid instead of depending on fermentation. With mineral tannages, the action of lactic acid is due to the hydroxy groups of the acid modifying the properties of the chromium and iron tanning-complexes. This is especially important in iron-tanning, a possible wartime substitute, as iron tannage without hydroxy groups from some source is not sufficiently stable for many uses.

Source of Methyl Acrylate

Efficient and inexpensive methods of converting lactic acid into its di-ester, methyl alpha-acetoxypropionate, are highly desirable, since this substance yields, on pyrolysis, methyl acrylate (a valuable synthetic rubber and resin intermediate) and acetic acid. Two methods of preparation were described by C. E. Rehberg, W. A. Faucette and C. H. Fisher, of the Eastern Regional Research Laboratory, Philadelphia. In the first process methyl alpha-acetoxypropionate is produced according to the following equations:

$$\underset{\text{Lactic acid}}{HOCH(CH_3)COOH} + \underset{\text{methyl acetate}}{CH_3COOCH_3} \longrightarrow$$

$$\underset{\text{methyl alpha-acetoxypropionate}}{CH_3COOCH(CH_3)COOCH_3} + H_2O$$

$$\xrightarrow{\text{Pyrolysis}}$$

$$\underset{\text{acetic acid}}{CH_2COOH} + CH_2 = \underset{\text{methyl acrylate}}{CHCOOCH_3}$$

The reaction between lactic acid of various concentrations and methyl acetate was studied under different conditions and it was found that both methyl lactate and methyl acetoxypropionate are produced in the reaction. Under some conditions 63.6 and 28.4 per cent. yields, respectively, of methyl lactate and methyl acetoxypropionate were obtained. This method of preparing methyl acetoxypropionate requires less acetic anhydride or ketene than the customary method, which consists in treating methyl lactate with either acetic anhydride or ketene.

Eliminating Acetic Anhydride

The second process enables the conversion of lactic acid to methyl alpha-acetoxypropionate to be carried out without the use of acetic anhydride, ketene or acetyl chloride. It can be summarised in two equations, representing successive reactions.

$$\underset{\text{Acetic acid}}{CH_3COOH} + \underset{\text{lactic acid}}{HOCH(CH_3)COOH} \longrightarrow$$

$$\underset{\text{acetoxypropionic acid}}{CH_3COOCH(CH_3)COOH} + H_2O$$

$$CH_3COOCH(CH_3)COOH + CH_3OH \longrightarrow$$

$$\underset{\text{methyl alpha-acetoxypropionate}}{CH_3COOCH(CH_3)COOCH_3} + H_2O$$

It was found that acetoxypropionic acid is formed satisfactorily when lactic acid, acetic acid, an entraining agent (such as benzene) and an esterification catalyst (such as sulphuric acid) are refluxed in such a manner that water is removed. Acetoxypropionic acid was then transformed into its methyl ester by treatment with either methyl acetate or methanol, the best method for esterifying acetoxypropionic acid being to pass this acid and methanol vapour countercurrently through a packed tower maintained at temperatures of 70° to 130°C. This method of manufacture would be particularly advantageous during wartime, as it would not require the construction of plant to convert acetic acid into acetic anhydride or ketene.

Chemical Resistance of Plastics

To Attack by Acids and Alkalis

PLASTICS used as constructional plant materials have the valuable property of resistance to chemical action, but the effectiveness of this property depends upon the kind of plastic and its physical structure. The different results obtained with different materials and different chemicals are shown in a report by John Delmonte, technical director of the Plastic Industries Technical Institute, Los Angeles, to the American Society for Testing Materials.* The effect of chemical attack was measured by noting the reduction of physical properties (punch and die test) at regular intervals, when samples of plastics were immersed in various solutions.

The acids selected for these tests were chemically pure nitric acid, sulphuric acid, and hydrochloric acid. Sodium hydroxide was employed as a representative alkali. The materials tested were laminated phenolic plastic, paper base, 1-16 in. thick; cellulose nitrate, 0.045 in. thick, black; cellulose acetate, 1-16 in. thick, clear; polyvinyl chloride acetate, 1-16 in. thick, cream colour; polystyrene, 1-16 in. thick; polymethyl methacrylate, 1-16 in. thick, clear; and laminated phenolic, glass base, 0.055 in. thick. All the specimens were placed in a drying oven at 50° C. for at least 48 hours prior to test.

Results of Tests

Polystyrene and polyvinyl chloride-acetate were practically unaffected by all the acid and alkali concentrations employed over the entire test period (about 800 hours). It is stated to be apparent that they are definitely superior to the cellulose acetate, cellulose nitrate, laminated phenolic paper, and polymethyl methacrylate. As between polystyrene and the polyvinyl co-polymer, polystyrene is more resistant to strong concentrations of sulphuric acid while polyvinyl chloride acetate is less affected by strong concentrations of nitric acid. However, in either case these materials are very much more resistant to strong concentrations of acids than the other plastics tested, which in a matter of several hours were entirely decomposed.

The method of decomposition varied somewhat. Some materials, like cellulose acetate, whitened on the surface and were eventually reduced to a shapeless mass of material. Others such as the laminated phenolic tended to de-laminate in nitric acid and swell in the presence of sodium hydroxide. On the other hand, there was a visible decrease of dimensions in hydrochloric acid.

Employing samples that previously had been placed in an atmosphere that was dry, 30 per cent. and 75 per cent. relative humidity, and immersed in water, for several days prior to tests, specimens of cellulose acetate were placed in a typical strong sodium hydroxide solution. The final strength of cellulose acetate indicated complete attack in all circumstances, though the effect of conditioning was shown in the length of time in which this is attained. Other plastic materials less susceptible to moisture than cellulose acetate were less dependent upon previous conditioning. In general, the drier a sample of plastic material, the less readily it will be attacked by acids and alkalies.

Caustic Soda Corrosion

One of the most interesting results observed in this series of tests was the fact that there is a certain range of concentrations of sodium hydroxide that is particularly active in its effect upon plastics. This range is around a 5N solution. Stronger concentrations of sodium hydroxide above this range have less effect upon the plastics.

With respect to the acids, the strongest concentrations brought about the most destructive results. However, here is some evidence in the case of sulphuric acid that a condition exists similar to that observed with sodium hydroxide. For most of the materials tested, the 1.06N solution of sulphuric acid was more active than the 4.3N or the 11.05N solution. However, the maximum available commercial concentration—34.6N—was very much more active than any of the lesser concentrations.

In the case of phenolic plastics particularly, the effect of the acid or alkali is determined not only by the synthetic resin but also by the base material serving as the reinforcement. Thus a phenolic plastic was attacked by nitric acid, while its glass base was impervious. For cellulose acetate, it is concluded that nitric acid is more active than hydrochloric acid, which in turn is more active than sulphuric acid.

* *Bulletin*, December, 1942, pp. 11-15.

Production of fuel alcohol in Australia at a rate of 14,000,000 gallons per annum is in sight, according to Mr. Beasley, Minister of Supply. A Commonwealth-owned grain distillery will start operating soon, and three more distilleries in the course of erection in Victoria, South Australia and Western Australia will increase the total alcohol production to 23,000,000 gallons. Maintenance of production is dependent on the supplies of raw sugar to the distilleries.

The Uses of Methyl Chloride*

American Methods of Preparation

METHYL chloride was discovered in 1835 by Dumas and Peligot. Its successful use as a refrigerant in Europe dates back to 1884, although it was restricted for the most part to small machines. In America, methyl chloride was practically unknown until the advent of the household and small commercial refrigerator for which its thermodynamic and other properties are eminently suitable. Commercial production of this chemical was undertaken in 1920.

The strict requirements of the refrigeration trade soon resulted in the production of a commercial chemical which is exceeded in purity by few " chemically pure " or reagent-grade materials. Methyl chloride, when first offered for sale as a refrigerant, met stiff competition from the earlier used sulphur dioxide and ammonia. Hence, to be competitive, methyl chloride prices were from the start held down to reasonable levels, but some adjustment has been possible with experience and increasing demand. Although foreign references suggest that methyl chloride is made commercially by heating trimethylamine hydrochloride, large-scale production in America has been limited to two other processes—*i.e.*, by the action of chlorine on methane and by the reacton of hydrochloric acid with methyl alcohol in the presence of a catalyst. In the former of these two processes, methylene chloride, chloroform, and carbon tetrachloride are also formed. Care must be taken to avoid explosive mixtures of the chlorine and methane and it is only within recent years that, even in the laboratory, the reaction has been capable of control to produce large proportions of the less highly chlorinated products. In the other process, the hydrochloric acid may be generated in the reaction mixture from salt and sulphuric acid or may be prepared separately by combining chlorine and hydrogen.

Solvent Uses

In addition to its widespread use as a refrigerant, methyl chloride serves as a catalyst solvent in certain synthetic rubber processes; as an extractant for greases, essential oils, resins, insecticides, etc.; as a dewaxing agent in the refining of petroleum products; and as an agent for methylation, chlorination, and other types of reactions in the preparation of various organic chemicals. One of its newest and potentially important uses is as a solvent for insecticides and fungicides to be applied by the recently developed aerosol technique. According to this method, the solution of the insecticide in methyl chloride, for example, is released from the container into the area to be treated. The pressure of the methyl chloride serves to discharge the insecticide in the form of a penetrating, very persistent suspension of minute particles which are more effective than when applied in the same amounts by ordinary spray methods. Because of its ideal volume relationships, excellent solvent properties, and low cost, methyl chloride appears to be an outstanding material for use in the aerosol technique for insecticide, fungicide, and other applications of this type.

Methyl chloride has long been known as an inexpensive and readily handled reagent for use in the preparation of the methyl Grignard reagent, CH_3MgCl. This material has recently taken on new interest with the development of the water-repellent materials formed by the hydrolysis of methyl silicon chlorides. These silicon compounds are prepared by the reaction of the above Grignard reagent with silicon chloride. High-melting plastic materials, the recently announced silicones, are prepared in a somewhat similar manner.

* From an article in *Chemical and Engineering News*, 1943, 21, 15, p. 1254.

Phosphate from Palestine

Production and Distribution

A REPORT prepared by Dr. A. Lohnberg of Jerusalem gives some details about Palestine's phosphate deposits. It states that friable raw phosphates have been found in slightly hilly country within limestone formations at the boundary of the Transjordan desert. One deposit is conveniently located near road and rail connection and stretches in several layers 50-200 cm. thick over a considerable area. Mining is done either by open-cast quarrying or by horizontal tunnelling. The quantities available are sufficient to meet any further demands of the Palestine superphosphate industry. The average quality of the raw phosphate—containing about 73 per cent. of tricalcium phosphate—compares favourably with the known North-African ores. The scheme of superphosphate production in Palestine based on the supply of raw phosphate from Transjordan owes much to the initiative and technical skill of Taassiyah Chemith Tel-Aviv, Ltd., the producers, to the United Kingdom Commercial Corporation, which paved the road for negotiations; production, supply and export; to Imperial Chemical Industries (Levant), Ltd., the distributors of the superphosphate, and to the Palestine Government Superphosphate Committee, now supervising the scheme.

Personal Notes

MR. A. B. BLUNSDEN is now manager of the Normanby Park Tar Supply Co., Ltd.

MR. A. D. DAVIDSON is now with Head, Wrightson & Co., Ltd., as a chemical engineer in the process plant division.

MR. A. B. WINTERBOTTOM has been appointed a senior investigator with the British Non-Ferrous Metals Research Association.

MR. GEORGE W. BURPEE has been elected president of the General Aniline & Film Corporation of America.

MAJOR W. I. ANDERSON, managing director of Associated Insulation Products, Ltd., has joined the board of British Industrial Plastics, Ltd.

MR. L. A. MUNRO, who has been employed as Director of Investigation and Statistics in the War Office since 1942, has resigned to enable the organisation and methods work to be handed over to the Director of Establishments, and is returning to I.C.I.

MR. CHARLES ALEXANDER HILL, who has been chairman and managing director of The British Drug Houses, Ltd., since its inception on January 1, 1909, resigned that position on September 30. DR. F. H. CARR has been elected chairman, and MR. F. C. OSCAR has been appointed managing director of the company.

New Control Orders

Coal Tar

THE Control of Coal Tar Order, 1943 (S. R. & O. 1943, No. 1356), which came into force on October 1 (with the exception of Part IV and Article 50 which became operative upon the making of the Order) is substantially the same as the 1942 (No. 2) Order of the same name. The main changes which are set out in an explanatory note printed with the Order, are :

Part I. Licences. Article 8 prohibits coal tar acquired or a coal-tar product disposed of under a licence granted for a specific purpose or under conditions, being subsequently knowingly dealt with (except by licence) for a different purpose or in contravention of the conditions.

Part II. Directions. Article 16. Under this Article the Minister may direct a person to dispose of any coal tar or coal-tar product treated, used or blended in contravention of the Order.

Article 19 is a revision of Article 17 of the 1942 Order, designed to attract to the price payable for coal tar acquired or a coal-tar product disposed of under a direction, any applicable increases or deductions authorised or required by the provisions of any relevant Coal Tar Products Prices Order.

Part IV is new and provides for the keeping of records and the furnishing of certain information by producers and distillers required to do so by notice served on them by or on behalf of the Minister. The records have to be kept and the information furnished on forms supplied by the Minister for the purpose.

Part V. Article 53. The definitions of coal-tar products and constituents (whether crude or refined) of coal tar have been revised, the former so as to include constituents of coal tar whether derived from coal tar or from any process connected with the extraction of crude benzol from gas, and the latter by naming certain constituents of coal tar.

Article 54, *Paragraph* 2, excludes from its scope the General Licence (Disposals) No. 1 which authorises the disposal by distillers or importers of coal-tar bases. Under the 1943 Order coal-tar bases may only be disposed of under the authority of a licence.

All applications for licences must be addressed to the Coal Tar Controller, Quebec House, Quebec Street, Leeds, 1.

Fertilisers

The Minister of Supply has issued the Control of Fertilisers (No. 27) Order, 1943 (S. R. & O. 1943, No. 1362) which, coming into force on October 4, revokes and remakes in consolidated form with amendments the Control of Fertilisers Orders, Nos. 5, 10, 17, 19, 21, 23. These Orders provided maximum prices for certain potash, sulphate of ammonia, basic slag, triple superphosphate of lime, ordinary superphosphate of lime, ground phosphate, and compound fertilisers. The principal amendment is that the maximum price of ordinary superphosphate of lime in Great Britain is now based on a standard price of £5 10s. per ton. Prices for Great Britain and Northern Ireland are in separate schedules. Provision has again been made for the usual early delivery rebates and for small lot additions.

POTASH IMPORTS

All persons or firms who, either as brokers or principals, imported in the ordinary course of their business caustic potash and/or carbonate of potash c.i.f., took up and actually paid against documents, and despatched to ultimate consumers or other distributors in their original imported forms an aggregate minimum quantity of 150 tons of solid caustic potash and/or 120 tons of carbonate of potash during the three years 1938/40 inclusive, are invited to write to Kalium, Ltd., c/o Thomson McLintock & Co., chartered accountants, 101 Cannon Street, E.C.4, not later than November 15, giving certified particulars of the quantities they so imported and distributed of caustic and/or carbonate of potash during the period specified. The figures for each commodity should be quoted separately.

Training within Industry

Labour Ministry Aids Employers

IN view of the growing stringency in the supply of labour, it is necessary for employers to pay close attention to the efficient utilisation of labour. In particular, quicker and more effective measures for training new entrants are now required. Practically all new recruits, even those to be employed on relatively unskilled work, will benefit from systematic training instead of being left to "pick up" the job by trial and error methods. Inadequate training of new workpeople is frequently responsible for excessive labour turnover, injuries to workpeople, damage to plant, excessive production of scrap, and low production per head. The Ministry of Labour and National Service therefore, in order to assist employers in setting up and developing adequate training arrangements, has made available special facilities which are outlined in a leaflet (P.L.125/1943), copies of which can be obtained from any local office of the Ministry.

The facilities available include the supply to employers of a manual (P.L.128/1943) dealing with the best methods of training new staff for production work, the provision of opportunities for selected managerial representatives to visit a Government Training Centre in order to study methods of training on the spot, and arrangements for Technical Officers of the Ministry, with special knowledge of training problems, to visit factories to advise, in the light of the needs of the individual establishment, on the setting up of training arrangements. In suitable cases and in so far as staff can be made available, members of the Ministry's Technical Staff may, on request, be allocated to firms, full-time, for a short period to assist in training arrangements.

Exports to South Africa

Priority Range Extended

IN July last year it was announced that the Export Licensing Department would not normally entertain applications for export licences in respect of exports to the Union of South Africa and Southern Rhodesia except for goods in respect of which a certificate of essentiality, issued by the appropriate authorities, with a priority rating between 1 and 5 inclusive, had been obtained. The Union and Southern Rhodesian authorities have now decided to extend the range within which they are prepared to consider applications for certificates of essentiality from persons desiring to import goods from the United Kingdom so as to include goods bearing a priority rating not less favourable than No. 8.

The Export Licensing Department can now entertain applications for licences in respect of goods supported by any certificates of essentiality that may be issued under these revised arrangements. It is pointed out that a certificate of essentiality with a favourable priority rating will not necessarily guarantee the issue of an export licence, since there may be other factors which render it impossible to sanction the export of the goods; nor will the issue of an export licence necessarily guarantee the provision of shipping space. Exporters are reminded that all exports in transit through the above territories are also subject to export licensing control.

Merchants and others who have consignments of goods which are ready for shipment to South Africa, and which, while not at present covered by certificates of essentiality, appear to be eligible to receive them under the revised arrangements, are recommended to apply to the Office of the High Commissioner for the Union of South Africa, Trafalgar Square, London, W.C.2, for the issue of such certificates. In the case of Southern Rhodesia all applications for certificates of essentiality must be addressed by the importers to the controlling authorities in Southern Rhodesia, and no application should be made to the High Commissioner's Office in London.

LETTER TO THE EDITOR

Plastic Pumps in Germany

SIR,—I notice in your issue of September 11 reference to a recent development in Germany of a plastic material to replace metals in the manufacture of pumps. Pumps built in our plastic material known as "Keebush" are now in use in hundreds of works throughout this country, particularly in the chemical industry, where severe corrosion has to be contended with. "Keebush" pumps have for a long while been made in a comprehensive range of standard sizes capable of handling from 10 to 200 gallons of liquor per minute, and these pumps have been shipped to North and South America as well as South Africa.

I may mention that our more recent developments include the manufacture of a special grade of "Keebush" which is completely resistant to hydrofluoric acid and a number of pumping installations have been put up in the last two years for handling this very difficult liquor. I write this to show how far we are in advance of the Germans!—Yours faithfully,

KESTNER EVAPORATOR & ENGINEERING Co., Ltd.,
B. N. REAVELL,
Managing Director

October 1, 1943.

General News

From Week to Week

Prospective candidates for the 1944 associate membership of the Institution of Chemical Engineers, are reminded that the closing date for entries is December 1, 1943.

The National Federation of Small Manufacturing Engineers has been registered as a company limited by guarantee without share capital.

Employees of 440 firms and organisations in England and Wales joined the Red Cross Penny-a-Week Fund during August. Workers in more than 44,000 firms are now contributing to the fund each week.

Wage increases for industrial canteen workers have been sanctioned under a Joint Industrial Council agreement, which comes into force with the week beginning October 11.

The American Chamber of Commerce in London now has its offices at Aldwych House, Aldwych, London, W.C.2, having vacated Bush House at the request of the Ministry of Works. The new telephone number is CHAncery 6735.

Oil phosphorus bombs are being used by the enemy in air attacks on agricultural land. A Government leaflet points out that crops splashed with the contents of these bombs must be destroyed, and animals must be carefully kept away from contaminated pastures.

The proceeds of a dance and a raffle held by the staff of I.C.I., Ltd., Distribution Centre, Northwich, combined with subscriptions from those who were unable to attend, and amounting in all to the handsome sum of £54, has been handed over as a donation to the Merchant Navy Comforts Service.

Food relief problems that will arise as the countries of occupied Europe are liberated were discussed at Saturday's conference of the Association of Scientific Workers in London. The meeting, which was attended by over 150 medical scientists, biochemists, and nutrition experts, passed a resolution urging the Government not to relax rationing until the needs of the European nations had been supplied.

Experiments in the use of low-grade fuels, such as slurry and coke breeze, have been carried out under the auspices of the Scottish Fuel Efficiency and Economy Committee. As a result, thorough mixing of three parts of such waste with one part of good coal appears to provide an efficient fuel for water-tube boilers, and it is stated that good coal can thus be saved up to 70 or 75 per cent. of total boiler consumption. The experiments are to be checked by Ministry of Fuel experts.

The first annual meeting of the Horticultural Fertilisers Association, Ltd., was held in London recently. Mr. Eric H. I. Brown, president of the Fertiliser Manufacturers' Association, was re-elected president of this organisation, which is made up of 40 manufacturers, six distributors, and two packers.

Coke of all sizes is now temporarily freed from restrictions, says the Ministry of Fuel and Power. This is to induce consumers to take part of their fuel requirements in coke, which can be used in place of the smaller sizes of anthracite and Welsh dry steam coal which are scarce.

The "Practical Planning" Exhibition organised by the Institution of Civil Engineers and the Institution of Municipal and County Engineers, was opened, in the premises of the former society, by Mr. W. S. Morrison, on Tuesday, and will remain open (free to all) until October 30. Conferences for engineers will be held on Wednesdays, at 2.30, for which tickets may be obtained on application to the Secretary of the Institution of Civil Engineers.

Pursuing its policy of circulating information about lac, the Indian Lac Research Institute, Ranchi, has issued Bulletins Nos. 47 and 49-53, as well as Research Notes Nos. 28, 29. Among the former are Parts VI and VII of Palit's "Physical Chemistry of Resin Solutions" (Nos. 52, 53), and "What Every Lac Cultivator Ought to Know," by P. S. Negi. Further particulars are obtainable from the London Shellac Research Bureau, India House, W.C.2.

The Chemical Council is recommending to the three chartered bodies that they should approve forthwith the co-option of two representatives of the British Association of Chemists as members of the Council. At the last meeting of the Council it was also decided to ask the three chartered bodies to suggest the names of other chemical bodies whom they think should be represented on the Chemical Council, so that it could become more representative of chemical thought.

A substantial bequest to the Mining Institute of Scotland was announced at the last meeting of that body. The president, Mr. John Finlay, said the sum made available to the Institute by the will of the late Mr. Sam Mavor, a former president, would in due course be considerable. This bequest bore further testimony to the keen interest which the late Mr. Sam Mavor had always taken in mining education generally. It would go a long way towards helping mining students in the future. The meeting agreed that Mr. J. B. Mavor should be invited to become a trustee for the administration of the fund.

A special scheme for reconditioning rubber boots for essential war workers has come into operation. An essential worker may hand his retailer a pair of boots fit for reconditioning, with a permit, which he can obtain from his usual authority. A day or two later, he will receive a pair, disinfected, cleaned, and reconditioned, without coupons, at a maximum retail price of 18s. 8d. as against 29s. for new boots. The scheme concerns knee-length industrial rubber boots of British or Canadian make, sizes 6 to 11, but does not affect ordinary repairs.

Since the outbreak of the present war, 339 men and women blinded on war service have been admitted to St. Dunstan's. Of these, over 100 have recovered useful sight and have been able to return to military or civilian life. Of the remainder, 87 are now at St. Dunstan's Hospital at Church Stretton, or have been transferred to the Training Centre, where they are acquiring normality and independence and later will learn an occupation or profession in order that they may attain economic independence as well.

Foreign News

The Order of Lenin has been given to the Gubakha coking and chemical works for its contribution to the Russian war effort.

The Schnitt chemical works, the largest of its kind in Rumania, has been damaged by explosions and fires reported to have been started by saboteurs.

Canada's crop of sunflower-seed oil is expected to be 10,500,000 lb. In spite of the greatly increased acreage under vegetable oil crops the Dominion will still need to import.

The aluminium plant at Herōya, Norway, was so severely damaged in the recent raid by American bombers, that it is quite likely that the Germans will have to give up the project altogether, said a Ministry of Economic Warfare spokesman last week.

Canadian Celanese, Ltd., is building a five-million-dollar plant at Drummondville, Quebec, to manufacture strong yarns, artificial wool, plastics, and some chemicals. It is understood that the new factory will require an additional 2000 employees.

The U.S. Rubber Director has disclosed that less than $70,000,000 will be spent in expanding tyre factories for the synthetic rubber programme, instead of the $95,000,000 originally planned, and only two new plants will be built.

The first car tyres made wholly of synthetic rubber are now coming off the production lines, states J. P. Sieberling, president of an important American rubber company. Few of these will be available this year, and so far no satisfactory all-synthetic lorry tyre has been made.

A programme of increased plastics production is being put into operation by Monsanto (Australia) Pty., Ltd., and to this end the company has, in conjunction with Gollin and Co., Pty., Ltd., taken over the business of Excelite Resins Pty., Ltd., manufacturers of phenol-formaldehyde resins and moulding powders, of Footscray, Victoria.

A new heat-insulating material called "Silica Aerogel" has been introduced in the United States. Sodium silicate is treated at a certain concentration with dilute sulphuric acid whereby a gel of 8 per cent. SiO_2 is formed. This is first washed with water, then with alcohol. Finally the gel is dried in an autoclave under high pressure and at a temperature of 290° C.

By rapid quenching of ordinary 1020 low-carbon steel, ultimate strengths as high as 190,000 lb./sq. in. are attained, stated M. Randall at the recent Pittsburgh meeting of the American Chemical Society. The process, invented by G. F. Nelson, quenches from a temperature of 925° C. with a 35 per cent. solution of sodium or potassium hydroxide at room temperature.

The Sociedad Iberica del Nitrogeno has established, in collaboration with the Montecatini concern, a factory for the production of synthetic ammonia at Felguera, Asturias, Spain. In connection with it a plant for the daily production of 130 tons of sulphuric acid will supply for a yearly production of 500,000 tons sulphate of ammonia.

Forthcoming Events

Mr. F. Thomas, M.Sc., F.I.C., will give a lecture entitled "Some Observations on American Progress in the Manufacture and Use of Synthetic Rubber" at a meeting of the Midland Section of the **Institution of the Rubber Industry** on **October 11,** at 7 p.m., at the James Watt Memorial Institute, Great Charles Street, Birmingham.

At the meeting of the **Chemical Society, Leeds area** section, on **October 12** in the Chemistry Lecture Theatre of Leeds University, Dr. E. H. Farmer will lecture on "Autoxidation in Relation to Olefinic Structure."

The joint meeting of the **Society of Chemical Industry,** and the **Institution of Chemical Engineers** on **October 12** will hear an address by Lord McGowan entitled "The Future of the Chemical Industry." The meeting is at 2.30 p.m. at the Institution of Mechanical Engineers, Storey's Gate, S.W.1

The **Society of Chemical Industry's Food Group** meets on **October 13,** at 3 p.m., in the Chemical Society's rooms, to hear papers under the general title of "Anti-oxidants," by Professor Hilditch, F.R.S., and Dr. F. Bergel.

Professor C. R. Harington's jubilee memorial lecture on "The Contribution of Chemistry to Immunology" will be delivered at a meeting of the Newcastle section of the **Society of Chemical Industry,** in the Physics Theatre, Newcastle University, on **October 13,** at 5 p.m.

The annual luncheon of the **Institute of Fuel** will be held at the Connaught Rooms, Great Queen Street, London, W.C.2, on **October 14,** at 12.30 for 1 p.m. The luncheon will be followed at 2.30 p.m. by the annual meeting at the same place, when Dr. E. S. Grumell, C.B.E., will be presented with the Melchett Medal and will then give the Melchett Lecture, to be followed by Dr. E. W. Smith's presidential address.

The Iron and Steel Institute holds its annual general meeting at 4 Grosvenor Gardens, London, S.W.1, on **October 14,** at 11 a.m. and 2.45 p.m. During the morning the following papers will be presented: "A Study of Austenitic Grain Growth in Medium-Carbon Steels," by J. H. Whiteley; "The Structure and Segregation of Two Ingots of Ingot Iron, One Containing Lead," by L. Northcott and D. McLean; and "Leaded Manganese-Molybdenum Steel," by T. Swinden. The papers at the afternoon session will be "The Solidification and Cooling of Steel Ingots," by E. F. Law and V. Harbord; and "The Physical Chemistry of Open-Hearth Slags," by J. White.

The third set of lectures on fuel economy arranged by the **Association of British Chemical Manufacturers** will be given on **October 15,** at 2.30 p.m., in the Geological Society's rooms, Burlington House, Piccadilly, W.1. The subjects will be "Grinding" and "Dryers, Heat and Mechanical" Brief introductions by Mr. J. C. Farrant (International Combustion, Ltd.) and Mr. F. R. Farmer (Kestner Evaporator & Engineering Co., Ltd.) will be followed by discussion. Non-members of the Association are invited to the meeting and should notify Mr. A. J. Holden (The Association of British Chemical Manufacturers, 166 Piccadilly, London, W.1) not later than October 13.

The inaugural meeting of the X-ray Analysis group of the **Institute of Physics** is to be held in the physics department of Manchester University from 2.30 to 6 p.m., on **October 16.** Sir Lawrence Bragg's lecture on "The Physical Optics of X-ray Analysis" will be followed by short papers by four speakers. C. W. Bunn, of I.C.I. (Alkali), Ltd., will talk on "Crystal Growth," and will illustrate his paper with films. The other papers are "Some Applications of X-rays to Industrial Processes," by L. D. Brownlee; "Correlation of Structure and Physical Properties of Alloy Steel," by A. H. Jay; and "A Rotating-Anode X-ray Tube," by I. MacArthur.

At a meeting of the **Institute of Fuel,** North-Eastern Section, to be held in the Central Station Hotel, Newcastle-on-Tyne, on **October 18,** at 5.30 p.m., Mr. J. G. Bennett, Director of the British Coal Utilisation Research Association, will give an address on "The Need for Industrial and Scientific Co-operation," which will be followed by a discussion.

The Royal Photographic Society will meet at 16 Princes Gate, London, S.W.7, on **October 19,** at 6 p.m., to hear papers by Dr. G. W. W. Stevens and Mr. P. C. Smethurst on "High Resolution Microphotography: Graticules."

The Agricultural Group of the **Society of Chemical Industry** meets in the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1, on **October 19,** at 2.30 p.m., to hear a lecture by Mr. W. Morley Davies on "Lime in Agriculture."

At a meeting of the **Chemical Society** at Burlington House, Piccadilly, W.1, on **October 21,** the following papers will be read: "Experiments on the Synthesis of Purine Nucleosides," by J. Baddiley, G. W. Kenner, B. Lythgoe, D. McNeil, A. R. Todd and A. Topham; "The Brönsted Relation in the Hydrolysis of the Halogenoacetates and the Theory of Acids and Bases," by G. F. Smith; and "The Course of Autoxidation Reactions in Polyisoprenes and Allied Compounds," by E. H. Farmer, H. P. Koch and D. A. Sutton.

The London section of the **Oil and Colour Chemists' Association** is holding a meeting at the Charing Cross Hotel, London, on **October 22,** at 6 p.m., to hear a lecture on "Management and the Chemist," by Mr. A. J. A. Kennedy, managing director of Ault & Wiborg, Ltd.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BASING LIME CO., LTD., Maidenhead. (M., 9/10/43.)—September 10, £1000 debentures. General charge.

SILICA GEL LTD., London, W.C. (M., 9/10/43.)—September 16, assignment, recur-

ing to Midland Bank, Ltd., all moneys due to become due to the Bank; charged on a contract. *£2040. August 10, 1942.

Satisfactions

FUSARC WELDING CO., LTD., London, E.C. (M.S., 9/10/43.)—Satisfactions, September 20, of mortgages registered April 28, 1942, and January 22, 1943.

METAL CASTINGS, LTD., Worcester. (M.S., 9/10/43.)—Satisfactions, September 15, of debentures registered March 23, 1926, to the extent of £15,000 and of a debenture registered September 7, 1938.

Company News

Murex, Ltd., is again paying a final dividend of 10 per cent. and a bonus of 2½ per cent., making 20 per cent. (same) for the year ended June 30.

The Oxley Engineering Co., Ltd., is to increase its capital, beyond the present authorised total of £100,000, by the creation of 400,000 new shares of 5s. each.

Aspro, Ltd., announce a net profit, for the year ended June 30, of £267,720 (£261,775), and have declared a final ordinary dividend of 15 per cent., making 25 per cent (same).

New Companies Registered

Samuel Bradley, Ltd. (382,861).—Private company. Capital: £5000 in 5000 shares of £1 each. Manufacturers of and dealers in dyes, dyestuffs, chemicals, paints, fertilisers, etc. Directors: S. Bradley; Mrs. Mary Bradley; J. Bradley. Registered office: 11 Peter Street, Manchester.

Chemical and Allied Stocks and Shares

THE industrial and most other sections of the Stock Exchange have remained firm, and although there has been no general improvement in values, individual features of strength have not been lacking. A better tendency continued in gilt-edged securities. As in industrial shares generally, the tendency among shares of companies connected with the chemical and kindred industries has been to favour those whose dividends in recent years have been reduced, the disposition being to assume that after the war distributions may very well return to the pre-1939 levels. Moreover, shares of companies in the plastics, textile and the building trades, have remained in favour on the expectation of expansion when the war is over. On the other hand, shares of companies which have had a relatively steady dividend record both before and since the war, have in many cases tended to ease. Among the latter, Imperial Chemical were lowered slightly to 38s. 6d., at which there is a not unattractive return on the basis of the 8 per cent. dividend, which is generally expected to be maintained for the current year; for the yield would still be higher than that on many shares, such as Wall Paper Manufacturers deferred, Boots Drug, Courtaulds and Distillers, which yield below 4 per cent.

B. Laporte continued to maintain their recent rise to 80s., and W. J. Bush were again 55s. Murex showed firmness at 100s. 7½d., "ex" the final distribution, which maintains the anticipated total payment for the year at 20 per cent. Tripiex Glass showed a good rally following their recent reaction, and were 39s.; sentiment reflected further consideration of the improved results, the strong balance-sheet, and market expectations of recovery in the rate of dividend after the war. Lever & Unilever were firmer at 36s. 9d. on the full report for the past year's working; the yield on the basis of the 5 per cent. dividend is less than 2¾ per cent., but this has to be considered in relation to widespread confidence of prospects of the dividend returning to the 10 per cent. level after the war. Borax Consolidated deferred at 37s. 6d. were relatively steady, as were Turner & Newall at 79s. 3d., Barry & Staines at 43s. 6d., and Nairn & Greenwich at 68s. 9d. At the time of writing small movements around 39s. 6d. were shown in Dunlop Rubber, and British Oxygen were 80s. 6d. Elsewhere, British Aluminium showed a better tendency at 46s. 7½d. Birmid Industries moved up o 84s. 6d. British Celanese were active around 32s. 9d., on expectations of the forthcoming results showing improved earnings. Courtaulds at 54s. 6d. were little changed on balance, while in other directions, Calico Printers and Bradford Dyers have held earlier gains. Wall Paper Manufacturers' deferred units recovered from 40s. 6d. to 41s. 6d., the disposition having again been to await forthcoming results. Associated Cement were higher on balance at 65s. 6d., and firmness was shown in British Plaster Board at 29s.

In the iron and steel section, Dorman Long remained in favour and have risen further to 31s. 6d. at the time of writing, while Babcock & Wilcox were better at 47s. 6d. Guest Keen were 35s., and United Steel were steady at 24s. 9d. xd., the dividend of the last-named company having been up to expectations. Tube Investments were 92s. 9d., and Stewarts & Lloyds deferred 53s. 3d.

Boots Drug were quite well maintained at 43s. 3d., as were British Match at 39s. 6d., Saugers at 23s. 10½d., and Timothy Whites at 33s. 7½d. Greeff-Chemicals 5s. ordinary were 7s. 9d., while William Blythe 3s. shares were quoted at 9s. Among plastics, British Industrial 2s. ordinary were again 6s. 10½d., and Erinoid 5s. ordinary were 12s., "ex"

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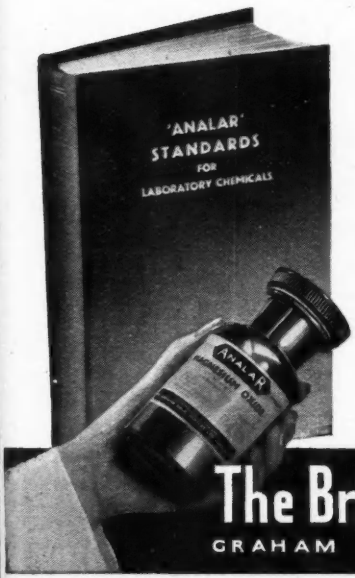

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the dividend which is again 10 per cent. Thomas De La Rue showed fluctuations, but at 172s. 6d. were maintained on balance. Elsewhere, British Drug Houses ordinary kept at 24s., and Monsanto Chemicals 5½ per cent. preference at 23s. 6d. Most oil shares were easier, but Anglo-Ecuadorian showed response to current dividend estimates.

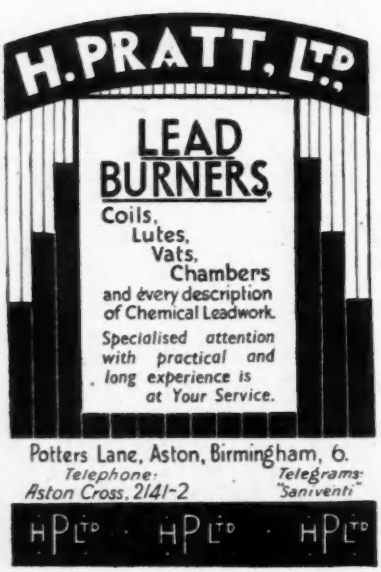
British Chemical Prices

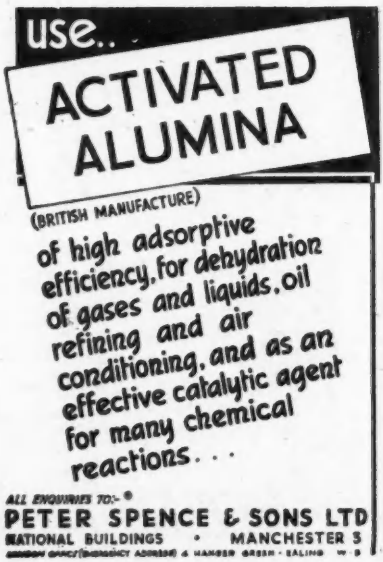
Market Reports

SATISFACTORY trading conditions have been reported from nearly all sections of the London chemical market, with a fair weight of fresh inquiry in several directions. Deliveries against existing contracts appear to be well up to schedule, and the price position throughout the market is steady with a firm undertone. With regard to the soda products, chlorate of soda is an active item, and a good inquiry is reported for bicarbonate of soda and soda ash. A good trade is passing for hyposulphite of soda and nitrate of soda, while no improvement in the supply position of yellow prussiate is reported. Glauber salt and salt cake are in steady request. The demand for the majority of the potash products continues on steady lines, with scarcity of supplies and firm price conditions the chief features. A steady inquiry is recorded for calcium, glycerine (pure and refined), peroxide of hydrogen and formaldehyde, while a moderate trade is passing in barium chloride and alum lump. White powdered arsenic is a strong item, and offers of borax are quickly absorbed. In the acid section a steady demand is reported for oxalic, citric and tartaric, and moderate quantities of salicylic acid are being taken up. Conditions in the coal-tar products market show little change on the week, and creosote oil, carbolic and cresylic acid continue in good call. Makers of pitch report a moderate inquiry, and the toluols and benzols are in good demand.

MANCHESTER.—Generally strong price conditions are a feature of the Manchester market for heavy chemical products, although there has been little in the way of actual further upward movements during the past week. There has been a fair flow of inquiry for a miscellaneous range of chemicals since the last report and, on the whole, not unsatisfactory order-book additions have been reported. Taking the consuming trades as a whole, good quantities are moving regularly against contracts, especially in the soda group. With regard to the tar products, sellers here report a generally brisk movement into consumption both in the heavy and light materials.

GLASGOW.—In the Scottish heavy chemical trade the slight improvement which has taken place during the past few weeks has been maintained for home business. Export inquiries and trade are still rather restricted. Prices remain very firm, with no actual changes to report.

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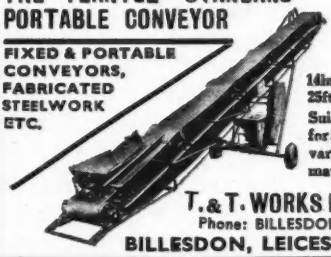

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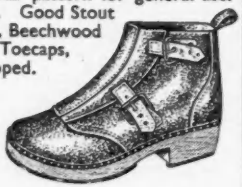

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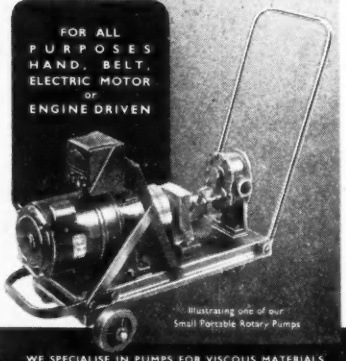

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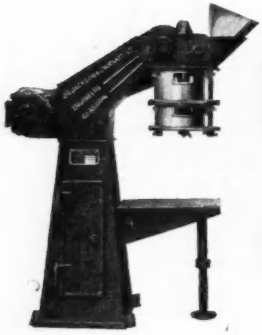

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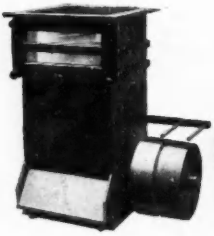

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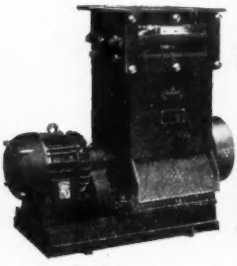

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No. 1
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